Health Consultation

VILLAGE OF WELLINGTON
(a/k/a WELLINGTON M.S. CLUSTER FACILITIES)

ENVIRONMENTAL CONTAMINATION CONCERNS

LORAIN COUNTY, OHIO

EPA FACILITY ID: OHR000018382

MARCH 17, 2005

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared by:

Ohio Department of Health
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Purpose and Statement of Issues

In March 2003, a resident from the Village of Wellington, Ohio, petitioned the federal Agency for Toxic Substances and Disease Registry (ATSDR) to conduct a public health assessment in Wellington, Ohio (Petitioner for Wellington, Ohio 2003). An increased incidence of multiple sclerosis (MS) cases had been identified in the village by the Ohio Department of Health (ODH) and Lorain County Health Department (LCHD) during a preliminary study carried out in 1998. The petitioner was concerned that emissions from one of the three principal industries located in the village (Sterling Foundry, Forest City Technologies, and LESCO, Inc.) were responsible for the high incidence of MS and other health problems. The petitioner also cited concern about the possibility of contamination from the Sterling Foundry landfill impacting the adjacent Wellington water reservoir and local soils.

Staff members from ODH and ATSDR-Region 5 conducted a site visit to Wellington September 4-5, 2003, to meet with the petitioner and other community members and to tour the community. They also met with representatives from the Ohio Environmental Protection Agency (OEPA) and Lorain County Health Department and obtained sampling data. The ODH and ATSDR accompanied the OEPA on an inspection tour of the defunct Sterling Foundry factory and the adjacent landfill.

Because of the preliminary finding of an excess number of MS cases in Wellington, the ODH and ATSDR agreed in a response letter sent to the petitioner in September 2003 to prepare a public health consultation to evaluate the available environmental data and to consider public health implications from this data.

Background

Land Use and Physiography

The Village of Wellington is in north-central Ohio, southwest of Cleveland. Wellington is located in a rural portion of south-central Lorain County, 6 miles south of Oberlin, in Wellington Township (Figure 1). Land use in the area surrounding the village is primarily agricultural with extensive fields of both corn and soybean row crops and herds of dairy cattle. The surface of the land in the region is mostly level, flat to gently rolling, with numerous small farm ponds dotting the landscape.

The village and the surrounding area are drained by two northward-flowing tributaries of the West Branch of the Black River. The Black River flows north through Elyria and Lorain before discharging into Lake Erie. Charlemont Creek flows along the west side of the village, draining agricultural areas in adjacent portions of Huntington Township, south and southwest of the village. The creek flows to the north-northeast, joining the West Branch just north of the village. Portions of Charlemont Creek have been diverted to form several surface water reservoirs, including two arcuate water bodies bracketing Jones Road roughly 1 mile south-southwest of town. These reservoirs have been replaced by a raised, above-ground, water-supply reservoir constructed in the 1970s at the southwest edge of the village, immediately adjacent to the county fairgrounds and west of the former Sterling Foundry facility (Figure 1). The village's wastewater-treatment plant discharges into a small, north-flowing tributary of Charlemont Creek at the northwest edge of the village. Wellington Creek flows along the east side of the village, draining agricultural land surrounding its primary source, Findlay Lake, 1.5 miles south of the village (Figure 1). From Wellington, Wellington Creek flows to the northeast prior to joining the West Branch 8–10 miles northeast of the village.

Previous water and biological quality sampling of water and sediment from Charlemont and Wellington creeks indicated that both waterways were strongly affected by agricultural runoff (Ohio EPA 1994). While the in-stream habitat was judged to be reasonably good, fish biota and bottom communities of aquatic invertebrates were only marginal. Ohio EPA (1994) indicated that both waterways were impacted by sediments and excessive nutrients resulting from soils and fertilizer washing off from adjacent farm fields, smothering the bottom with mud, fueling excessive algae growth, and reducing dissolved oxygen levels. Charlemont Creek additionally was impacted in 1992 by nutrients being discharged by the Wellington Waste Water Treatment Plant (Ohio EPA 1994). However, water and biological quality in both creeks demonstrated no evidence of impacts due to toxic chemicals in surface waters or sediments.

Climatic conditions are typical of north-central Ohio with precipitation in the area averaging 34 inches per year (Barber 1988). Prevailing winds in the area are usually from the west, typically from the southwest in the summer and from the northwest in the winter.

Geology and Water Resources

Groundwater resources in this part of Lorain County are generally poor (Hartzell 1994). The underlying geology of the area consists of glacial tills (poorly-sorted mixtures of clay and silt with lesser amounts of sand and gravel) overlying clay-rich shale bedrock (Barber 1988; Ohio Department of Natural Resources water well logs). Soils and bedrock are largely impermeable, limiting the storage and movement of groundwater into and out of these layers. Most wells in the area produce water at levels less than 5 gallons per minute. Wells located west of the village in the general vicinity of Charlemont Creek have somewhat better yields, obtaining up to 20 gallons of water per minute from thin sand and gravel layers separated from the ground surface by 20 to 50 feet of clay-rich till (ODNR well logs).

Because of the poor groundwater resources in the area, Wellington residents historically have obtained their drinking water from three surface-water reservoirs formed by the impoundment of water that is seasonally diverted from Charlemont Creek. As indicated above, these resources include two small lakes along Jones Road southwest of the village and a larger, raised, above-ground, bermed, 1.3 billion gallon surface-water impoundment at the southwest edge of the village, located 700 feet west of the former Sterling Foundry and 400 feet south of the county fairgrounds (Figure 2).

The bermed 200-acre reservoir rises 50 feet to 80 feet above the surrounding land area, including the adjacent parking lot of the Sterling Foundry plant to the east and the county fairgrounds to the north. Several above-ground storage tanks associated with the treatment system of the water supply are also located in this same area. The Wellington water plant has a capacity of 1.5 million gallons per day and services a population of 4,600 people through 1,700 service connections. Treatment systems include carbon filtration, fluoridation, and chlorination. To date, the water system has a good compliance history with federal and state drinking water supply regulations (Ohio EPA, NEDO personal communication 2004). These water resources are located hydrologically upgradient (uphill) and largely upwind from the village and the identified industrial facilities (Figure 2).

Demographics

The village was established in 1818 and has more than 200 buildings on the National Register of Historic Places. Wellington is primarily a community of tree-lined streets and tidy, single-family homes. The village also has a limited number of commercial businesses, including a variety of manufacturing, service, and retail operations. Industrial facilities include the former Sterling Foundry, an adjacent steel-fabricating company, and a former tool-and-die facility, all clustered at the west end of Erie Street; the former LESCO, Inc. facility south of the railroad tracks at the south edge of town; several buildings operated by Forest City Technologies along the railroad tracks near the center of town; and, a pipe-fitting plant on State Route 58 at the north edge of the village.

The CSX railroad tracks run southwest-northeast through the middle of the village. Train traffic on this line is heavy. A second set of tracks belonging to Norfolk & Southern, less heavily used, runs from the southeast to the northwest through the southwest part of the village and crosses the CSX line at the Sterling Foundry site (Figure 2).

The village has a population of approximately 4,500 residents; 97% of the population is white. The median age is 35.2 years and 73% of the population is 18 years or older. Women comprise 52% of the population. The 2000 population for Lorain County was 284,664; the three major ancestries reported for Lorain County were German (25.8%), Irish (15.0%), and English (10.6%).

Discussion

Potential Industrial Point Sources

<u>Sterling Foundry</u>

The Sterling Foundry facility was built in the 1920s at the west end of Erie Street at the southwest edge of Wellington. The foundry has had a series of owners since the 1920s; the latest being Sterling Foundry, Inc. (SFI), who purchased the assets of the foundry out of bankruptcy in the early 1990s. SFI started phasing out operations in the late 1990s and ceased operations in November 2002. The facility is currently undergoing closure under Ohio EPA's Cessation of Regulated Operations program (Ohio EPA, personal communication July 2003).

The facility consists of the main operations building trending roughly northwest to southeast at the south end of Erie Street, three smaller warehouse buildings in a parallel configuration to the west, and four small settling ponds just west and south of the warehouse buildings. The settling ponds received stormwater runoff from the facility and functioned as retention ponds to store runoff and to allow solids to drop out of the water prior to discharge to a drainage ditch on the west side of the Sterling property. An 8-acre landfill used for the disposal of foundry waste is located immediately to the south of the facility (Figure 2).

Identified pathways for the possible release of potentially hazardous materials to the environment include air emissions from foundry operations at the plant, oils and metals to surface waters and sediments in the four settling ponds, and foundry wastes (oils and metals) to soils and possibly groundwater under the Erie Street Landfill.

Foundry Air Emissions

The former Sterling Foundry was a medium-sized facility that produced gray and ductile iron castings, primarily for heavy industry. Airborne emissions from similar facilities occur mainly during the melting of scrap metal and during mold preparation. The primary emissions from melting operations include particulate matter, carbon monoxide, organic compounds, sulfur dioxide, nitrogen oxides, and small quantities of chloride and fluoride (US EPA 1995). The primary pollutants emitted from mold production operations are particulates from sand reclamation, sand preparation, mixing of sand with binders, and mold and core forming (US EPA 1995). It is unknown whether these same substances were released to the environment from the Sterling Foundry facility because inadequate historical sampling data exist to fully identify past emissions from the facility.

In the mid-1990s, the Ohio EPA received a number of complaints from Wellington residents concerning dust fall-out and odors from the facility (Ohio EPA, memorandum 1995). Subsequent investigations of the facility by Ohio EPA discovered that the plant's air pollution control equipment had deteriorated during a down-time between owners and that several sources of air pollution at the facility were operating without any effective control equipment. As part of the notice of violation sent to Sterling Foundry by Ohio EPA, the company was required to repair or replace the faulty air-pollution control equipment and also identify potential hazardous substances in the waste streams generated by the facility's operations (Ohio EPA, letter to Sterling Foundry 11/28/95).

A 1995 inspection of the facility by the Division of Hazardous Waste Management at Ohio EPA noted several solid waste streams at the facility, including spent foundry sands, bag house dusts from abrasive blasting operations, core butts and foundry sand mold parts, and various cleaning solvents. To address the violations noted by Ohio EPA with regard to the foundry's operations, the operators were asked to better characterize the types and amounts of waste in 1) bag house dust from abrasive blasting operations, 2) bag house bags, 3) used hydraulic oils, 4) settling pond sludges, and 5) the contents of drums observed in the facility paint area.

Additionally, during an Ohio EPA inspection on June 8, 1995, thick, black, oily smoke was observed being emitted as the result of the melting of scrap metal that had been coated with oil and the overcharging of the furnace, leading to the formation of heavy visible emissions. Ohio EPA required that the facility use only clean, oil-free scrap metal and that they operate the furnace effectively and not overcharge it with metal (Ohio EPA, June 8, 1995). Continued use of oily metal scrap would require additional pollution controls on the furnaces.

The primary environmental exposure concern with regard to the Sterling Foundry, for the purposes of this health consultation, is airborne contamination, primarily dust and fumes generated from the various processes carried out in the main operations building. The facility is upwind of most of the residential portion of the village. The company analyzed chemical composition of the spent foundry sand and dust collected in the bag houses for metals, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs). These data were presented to Ohio EPA in a letter dated February 8, 1996. Analytical results of the leachability of spent foundry sand and bag house dust indicated the presence of the metals chromium and barium and the VOCs o-Cresol and benzene. These data indicated only the levels (parts per million) of these chemicals that could be leached from the samples, not the actual composition of dust being emitted from the facility. A 2001 table provided by Clean CEMP to Sterling Foundry estimated VOC emissions from core and molding processes to include 11.7 tons of isopropyl alcohol and much lower levels of the solvent naptha and mineral spirits. If concentrations were high enough, all three of these chemicals could be respiratory and eye irritants (Sittig 1985).

Self-reported emissions reported to US EPA's Toxic Release Inventory (TRI) for the Sterling Foundry facility from 1998, 2000, and 2001 indicate annual release of chromium (500 lbs.) and methanol (5,000 lbs.) to the air on-site and off-site disposal of up to 43,400 lbs. of chromium waste. Review of the Title V air permit for SFI and reported emissions data for the various permitted air pollution sources does not indicate that the facility had a history of being out of compliance in terms of its permitted releases (Tables 1, 2). The largest releases of organic compounds (methanol) from SFI came from the on-site storage areas that evidently were not regulated (Ohio EPA 2001). In an enclosed indoor air environment, methanol can be toxic to humans, targeting the central nervous system (World Health Organization 1997). In an outdoor-air environment, methanol levels would be reduced due to mixing with the atmosphere and the methanol being rapidly oxidized to carbon dioxide. These data do not necessarily mean that off-site residents were exposed to these chemicals at concentrations of health concern. These data do show the estimated volumes of these chemicals the company likely released at the facility to the ambient air at that time.

Based on limited site-specific data and literature about emissions likely to result from these ductile iron operations (US EPA 1995), it is likely that the primary constituents emitted into air from operations at the SFI facility were particles of silica (quartz sand). As this substance is chemically inert, exposure to silica dust from the site likely would not have led to health problems other than short-term eye and respiratory effects associated with the release of emissions to downwind residential populations (most of the residential portion of the Village of Wellington). Other likely air pollutants would be carbon black and other organic compounds associated with the black soot generated by the melting of oil and grease-coated scrap metal in on-site furnaces, plus low levels of isopropyl alcohol and methanol.

Sterling Foundry settling ponds

Cooling water and stormwater-runoff from the facility was diverted to a series of four small ponds at the southwest corner of the facility, which were used as unlined "settling ponds." These small ponds allowed particulates and oils leaving the site to be caught and to settle out as sediments prior to the water being discharged to a largely open drainage ditch located on the west of the Sterling Foundry, between it and the raised reservoir. Sampling of the surface waters and sediments in these ponds occurred in 1992. At that time, a thick oily layer was observed floating on the surface of Pond #1, and the banks of the pond were stained black. Elevated levels of "total petroleum hydrocarbons" (TPH) were detected as sludge in sediments in Ponds # 1 and #3 (CTL Engineering 1992). These petroleum sludges were the result of successive spills and releases of hydraulic oil to the interior drainage system in the plant and their subsequent release to the adjacent settling ponds.

In addition to TPH, comparatively low levels (less than 30 parts per million/ppm) of the metals arsenic, barium, cadmium, and lead were detected in pond sediments. Sediment samples from Ponds #1 and #3 also had polychlorinated biphenyls (PCBs) at elevated levels (102 and 223 parts per million, respectively). Under US EPA Toxic Substances Control regulations, these sediments would be classified as hazardous waste based on their PCB concentrations. Surface waters in the ponds had no detections of volatile organic compounds (VOCs). Additional sampling was recommended of the sediments in Ponds #1 and #3 at the time of the 1992 report. Similar levels of TPH and metals were detected in pond sediments that were sampled again in 1996 (Sterling Foundry, letter to Ohio EPA 1996). No additional information was found in Ohio EPA files concerning further sampling of the ponds or the removal of site-impacted pond sediments.

Currently, the settling ponds are fenced off with a locking gate and surrounded by dense vegetation. TPH, PCBs, and most of the heavy metals detected in pond sediments are not water soluble, are not very mobile, and are likely tied up as semi-solid sludges in the pond sediments. The nature of these contaminants limits the likelihood of their moving off-site in surface water run-off or by seeping through underlying clay layers to the shallow groundwater on-site. Fish and frogs were observed in one of the ponds during the site visit in September, 2003.

Erie Street Landfill

Sterling Foundry operated an unlicensed, unregulated, 8-acre landfill adjacent to the plant that historically received foundry waste generated by the facility. The waste included waste foundry sands, plastic bags full of bag house dust, metal fragments, slag, and some general refuse (plastic sheeting, rubber stripping and hosing, and lumber). The native soil had been removed from central portions of the landfill and the resulting void was filled primarily with foundry sand and slag. The thickness of the waste layer within the landfill varied from 1 foot to 20 feet thick and was thickest at the southeast corner of the landfill and thinnest at the landfill's northeast corner (URS Greiner Woodward 1999). In 1995, Ohio EPA required that the landfill cease activities and that SFI properly characterize the waste disposed of in the landfill prior to its engineered closure.

The Erie Street Landfill is located roughly 500 feet due east of the Wellington above-ground reservoir that serves as the source of drinking water for most of the village's residents. However, its surface is at least 25 feet below the level of the water in the bermed reservoir; therefore, the landfill is down-gradient from the reservoir. Surface water run-off from the landfill drains to a ditch that runs the length of the landfill at its northern end, which discharges to a concrete culvert at the northeast corner of the landfill. This culvert feeds into an open ditch that flows to the north between the east berm of the reservoir and the SFI parking lot. The surface of the landfill is highly irregular, with highs in the corners and a low marshy area in the middle.

During the site visit on September 5, 2003, heaps of slag, metal, foundry sand and solid waste, including plastic sheeting, rubber stripping, and tires, were observed exposed at the surface. Sixteen 55-gallon drums that contained drilling wastes and decontamination water were also observed on-site. A small pool of black, oily water was observed seeping out of a pile of black foundry sand near the north-central portion of the landfill. A dense growth of trees surrounds the landfill along its perimeter. Most of the interior of the landfill supported grasses, perennial weeds, and small shrubs. Low-lying portions of landfill near the center and to the north and east were poorly-drained and supported a dense growth of cattails. The landfill site is not fenced. At the time of the site visit, evidence was observed of people coming on-site, including tire tracks from ATVs or motorcycles and beverage containers.

Four monitoring wells are located in the landfill, and three more monitoring wells are north of the landfill along an east-west access road. Soil borings in the landfill indicate a variable thickness of fill (primarily foundry wastes) at the surface, underlaid by 5–15 feet of sand and at least 45 feet of clay-rich till. A second sand stringer, usually less than 5-feet thick, occurs about 45 to 55 feet below the ground surface. Groundwater flow in the upper sand layer is the northeast. Groundwater flow in the deeper sand stringer is to the east, away from the direction of the reservoir (URS Greiner Woodward Clyde 1999). As is typical of low-yield, marginal aquifers like the on-site glacial till, groundwater quality for these monitoring wells was poor, with elevated levels of total dissolved solids (up to 3,000 parts per million). The majority of the chemicals detected in the on-site groundwater were metals, including arsenic, chromium, iron, lead, and nickel, most at levels exceeding federal public drinking water standards (Table 3).

Wastes in the landfill consisted primarily of foundry sand, bag house dust, and slag. Chemical sampling of landfill wastes indicated low levels of VOCs and metals at background levels. Concentrations of several polycyclic aromatic hydrocarbons (PAHs) exceeded Ohio EPA Volunteer Action Program commercial soil standards but, with the exception of benzo(a)pyrene, were typical of levels that have been observed in urban soils elsewhere (ATSDR 1995).

LESCO, Inc.

The Lakeshore Equipment and Supply Company (LESCO) facility in Wellington is located at the south edge of the village in a predominantly commercial area (Figure 1), south of the railroad tracks on the east side of State Rt. 58 (Main Street). The LESCO property consists of a number of now-abandoned, single-story, warehouse-type buildings situated on a level, grassy field area. A farm and garden equipment company is located directly to the south, and a B.P. gas station is across the street to the west. The closest residences upwind and upgradient of the facility are located 1,000 feet to the north, north of the tracks, just west of the junction of Main Street and Cemetery Road. Surface water run-off from the LESCO property appears to drain to the east and northeast towards Wellington Creek. The area east of the facility is largely agricultural pasture land.

The Wellington facility appears to have been used primarily as a distribution center, repackaging bulk product into smaller wholesale lots and distributing these to its customers, primarily lawn-care professionals, golf courses, athletic fields, and cemetery operators. Fertilizer was formulated and produced at the Wellington facility in the 1970s. Products produced, packaged, or warehoused at the facility included a variety of fertilizers, herbicides, and pesticides. Potentially hazardous materials included the herbicides 2,4,D and Diquat; the pesticides Dursban (chlorpyrifos), Diazinon, Carbaryl, Fonophos, Malathion, and Methoxychlor; and a variety of "horticultural oils" used as solvents for pesticide applications (LESCO, Inc. February 21, 2000). These oils contain the solvents xylene and 1,2,4 trimethylbenzene.

LESCO ceased operations at the Wellington facility in 2002. A review of Ohio EPA's files on this facility conducted by ODH staff in July 2003 indicated that the company processed and stored a variety of hazardous materials on-site. Self-reported TRI data (US EPA) for the facility during the 1990s indicated the annual release of small quantities (1,000 lbs or less) of a number herbicides and pesticides to air at the facility. Chemicals released included the herbicides 2,4-D, Pendimethalin, and Trifluralin; and the pesticides Carbaryl, Chlorpyifos, Isofenphos, and Quintozene. Total estimated releases averaged about 4,000 lbs. per year during the time period from 1996 to 2000.

Forest City Technologies

Forest City Technologies, Inc. has operated in Wellington, Ohio, since the late 1950s. The company was originally named the Wellington Foam Rubber Company. Forest City Technologies now has five locations in the village, which includes facilities on Magyar Street, just north of the county fairgrounds and the railroad tracks, close to the center of the village. The various plants are all located in close proximity to residential neighborhoods. The company produces seals, gaskets, and o-rings for the automotive industry as well as various synthetic coatings for fasteners and other metal parts.

Hazardous materials used in on-site processes included several products termed "primers" that contained significant amounts of the volatile organic compounds (VOCs) toluene, xylene, and ethyl alcohol (Forest City Technologies, letter 1/25/02). Although considered to be hazardous substances, none of these chemicals are human cancer-causing agents, and they result in adverse health effects only upon acute exposures to very high concentrations of these chemicals (parts per million range). Compliance air-monitoring data from 1995 indicated that all but one of the coating operations were in compliance with their allowable VOC emissions (Ohio EPA 1995A). The one out-of-compliance operational unit exceeded the allowable emission rate by only 0.007 lbs./hr. Other violations cited by Ohio EPA included the adding of additional process units without reporting these additions to Ohio EPA and adjusting air pollution control equipment to account for these additional production units. The facilities operator was, at the time (1995), under the impression that these additional machines could be added to their production line without requiring additional pollution control equipment or additional paperwork.

TRI data for the Forest City Technologies Plant #4 on Magyar Street were available for the time period from 1988 to 2001. During this time, the facility released up to 40,000 lbs. of the volatile organic compound dichloromethane (also called methylene chloride) per year to the on-site air. Dichloromethane is a chlorinated solvent used in a vapor-degreasing process at the plant. Levels of dichloromethane released to the air from the facility declined steadily throughout the 1990s, from a high of 40,000 lbs. in 1994 to 10,000 lbs. in 2001 (US EPA TRI Explorer 2004). Based on review of the Title V Air Permit for Forest City Technologies (Ohio EPA 1998) and comparisons with reported air emissions data (Table 4), the levels of dichloromethane released from the facility were within the permitted levels for the plant (up to a maximum of 32.6 tons or 65,000 lbs per year). Dichloromethane (DCM) is a "probable" human cancer-causing substance based on lab-animal studies. Chronic exposure to high concentrations of DCM in enclosed occupational settings (> 200 ppm in air) has led to central nervous system depression and infertility in workers (ATSDR 2000). Due to mixing with the ambient air upon release to the environment, the levels of DCM that nearby residents may have been and might still be exposed to are unknown. It is unlikely that nearby residents were exposed to DCM released to the air from the plant at levels high enough to cause adverse health effects in these residents.

Human Exposure Pathways

Area residents have to come into physical contact or *be exposed* to chemical contaminants in the environment in order for these chemicals to cause the development of adverse health effects in these residents. In order for a person to come into contact with the chemicals of concern, there must be a *completed exposure pathway*. A completed exposure pathway consists of *five main parts* that must be present for exposure to occur. These include a:

- **source** of the hazardous chemicals;

- method of **environmental transport—** the method that allows the chemicals to move from the source and bring it into contact with the residents (surface water, groundwater, soil, dust, vapors, soil gas);

- **point of exposure—**the point where the resident comes into physical contact with the chemical;

- **route of exposure—**the route how the resident comes into contact with the chemical (drinking it, eating it, breathing it, touching it); and

- **population at risk—**the people who live near the chemical contamination and come into contact with the chemicals from the site.

Exposure pathways can also be characterized by when the exposure occurred in the *past or present* or when it might occur in the *future*.

Physical contact with a chemical contaminant in and by itself does **not** necessarily result in adverse health effects. A chemical's ability to affect the resident's health is also controlled by a number of other factors, including:

- How much of the chemical a person comes into contact with (the *dose*);

- How long a person is exposed to the chemical (duration of exposure);

- How often a person is exposed to the chemical (acute versus chronic);

- The chemical's toxicity and how it impacts the body.

Other factors affecting a chemical's likelihood of causing adverse health effects upon contact include the resident's:

- history of past exposure to chemicals;

- smoking, drinking of alcohol, or taking certain medicines or drugs;

- current health status;
- age and sex; or
- family medical history.

Community Health Concerns

The community has voiced several health concerns, especially MS and to a lesser extent, cancer, fibromyalgia, and lupus, related to residing in Wellington. The occurrence of MS in the community has been evaluated by the Ohio Department of Health (ODH) and the Lorain County Health Department (LCHD) by using a cluster study of Wellington and Wellington Township and a prevalence study of Lorain County. The ODH and LCHD plan to study the incidence of cancer in the community sometime in 2005 using the state cancer registry database. No databases are available for fibromyalgia and lupus analyses. Limited medical literature is available that addresses environmental exposure-related factors for these health concerns. These health issues will be addressed in this section.

Multiple Sclerosis

Health and Disease Outcomes

In 1998, the Ohio Department of Health and Lorain County Health Department evaluated the village of Wellington and Wellington Township for the possible occurrence of an MS cluster (Indian 2001). The state identified 25 definite and probable cases of MS in the community of 4,200 people, or a crude rate of 595 cases per 100,000 people. This result was markedly elevated from the national average of 58 to 160 cases per 100,000 people. Using data from the National Health Interview Survey, the standardized incidence ratio was calculated as 3.7 (95% confidence interval 2.4–5.5), meaning that members of the community were 3.7 times more likely to develop MS than the rest of the country.

Upon identifying the increased number of MS cases in the Wellington area, the ODH and LCHD expanded their surveillance to all of Lorain County. The prevalence study was designed to identify cases of MS during the period of 1998–2000 by gender, age, and race/ethnicity. Cases were defined as individuals who had an MS diagnosis confirmed by a neurologist who had visited a physician during the study period and also resided in Lorain County during the study period. Cases were included even if the individual had subsequently died or left the area. This study determined that the prevalence of MS in Lorain County is comparable to that of similar population in the United States (R. Indian, personal communication, ODH 2/23/05).

Neither the cluster study in Wellington nor the prevalence study of Lorain County were designed to identify possible causes for the excess number of cases of MS in the community. The purpose of these two studies was to evaluate whether an elevated rate of MS was present in the community. The ATSDR, through local and state public health departments, is planning to conduct an MS case-control study that includes Lorain

County as a follow-up to the prevalence study, and this study is scheduled to start in 2005. Two other geographic areas in the United States will also be part of the case-control study: Independence and Sugar Creek, Missouri, and a 19-county area surrounding Lubbock, Texas. The purpose of the case-control study is to examine the occurrence of MS and environmental exposures, genetic susceptibility, and exposures to infectious disease. The study will include blood samples to examine specific genes and infectious diseases and a questionnaire.

Discussion

MS is an inflammatory autoimmune disorder that results in the destruction of myelin (the fatty sheath that surrounds and protects nerve fibers) on nerves in the central nervous system. The signs and symptoms of this disorder reflect the sites in which nerve conduction is impaired. These symptoms can include weakness, painful spasms, bladder dysfunction, vision disturbances, impaired speech or swallowing, tremor, poor balance, difficulty with coordination, or cognitive impairment. MS has a variable course of episodes with recovery, episodes leaving persistent deficits, or progression. This lifelong chronic disease is one of the most common causes of neurological disability in young adults. Development of MS appears to result from an interplay between genetic and environmental factors.

MS affects twice as many women as it does men, and usually occurs in the third or fourth decade. The disease predominantly affects whites, most notably of northern European ancestry. The incidence is about seven new cases per 100,000 people every year, the prevalence is about 120 per 100,000, and the lifetime risk is one in 400 (Compston and Coles 2002). Prevalence studies in the United States show a lower rate of MS in the South than in other regions of the country. The prevalence in women appears to be increasing. In the Midwest, the prevalence was 138 women per 100,000 and 54 men per 100,000 (Noonan et al 2002). The raw prevalence of MS in Olmsted County, Minnesota was determined to be 177/100,000; both the prevalence and incidence of MS in Olmsted County appeared to be stable over the past 20 years (Mayr et al 2003).

Genetic epidemiologic studies have shown that the disease occurs more often in family members than in the general population. A first-degree relative of an individual with MS has a 3%–5% age-adjusted lifetime risk of getting the disease; an identical twin has a 38% age-adjusted lifetime risk (Sadovnick 2002). Because the risk for an identical twin is not 100%, it shows that some nonhereditary factors are also important.

Numerous environmental (nongenetic) factors may contribute to the development of MS. These factors include exposure to viruses such as measles, canine distemper, and herpes; various vaccinations; significant head or spinal trauma; stress; diet and nutritional habits; and exposure to toxins. Studies on workers exposed to organic solvents show that a weak association between solvent exposure and the development of MS may exist (Landtblom 1997; Riise et al 2002). Other studies do not support the association of organic solvents and MS (Mortensen et al 1998). An increase in the number of MS cases was reported for employees chronically exposed to zinc at a manufacturing plant (Stein et al, 1987; Schiffer et al, 1994). A cluster of MS cases was also reported in a community with significant environmental heavy-metal exposure from a zinc smelter (Schiffer et al 2001). A case-control study in Galion, Ohio (Hopkins et al 1991) found that persons with MS were more likely to have a history of allergies and to recall having two or more relatives with neurological diseases, having received oral polio vaccine, or having owned a cat that had died of unexplained causes. Both cases and controls had similar levels of antibodies to the four viruses tested. Some researchers believe that the environmental factors may also influence the disease progression and its prognosis (Casetta and Granieri 2000).

Cancer

Community members in the Wellington area have expressed concern about the number of people with cancer in their community. The Ohio Department of Health reports that the incidence of cancer in the community has not yet been evaluated. However, using the cancer registry database for the state of Ohio, the ODH, and the Lorain County Health Department have evaluated the incidence of cancer in Lorain County and found it comparable to that of the state of Ohio. Further, the Lorain County Health Department and the ODH will evaluate cancer incidence at the community level, including Wellington, for diagnosis years 1996-2002 during 2005 (R. Indian, personal communication, ODH 2/23/05). Analyses of new cases of cancer based on registry data are considered exploratory. Information on individual risk factors for developing cancer and the length of time an individual may have resided in a community is not included in the database.

Cancer is a group of related diseases that are noted by the uncontrolled growth and spread of abnormal cells in the body. Cancer is common; there is a lifetime risk of one in three of getting cancer. Cancers, other than leukemia, usually have long latency times between exposure and onset of clinically recognized disease. Latency periods can be more than 10 years; therefore, new cancers diagnosed in the 1990s may have started in the 1970s or 1980s. Cancer has many causes, and the leading preventable cause of cancer is cigarette smoking. Pollution is estimated to account for only one to five percent of human cases (cited in Rushton 2003).

Fibromyalgia

Fibromyalgia is a common rheumatoid disorder (not involving the joints) characterized by fatigue and achy pain, tenderness, and stiffness of muscles, ligaments, and tendons. Some people with fibromyalgia have been found to have changes in some brain chemicals related to pain. It is estimated that 3 to 8 million people in the United States are affected by this chronic condition. No public health reporting system for fibromyalgia exists in the state of Ohio or the town of Wellington, so prevalence rates in the Wellington area cannot be evaluated.

The cause of fibromyalgia is unclear, but it is probably due to contributions from several factors. Some of the triggers or leading events in the development of fibromyalgia include sleep disturbances, injury to the upper spinal region, viral or bacterial infection, psychological stress, and hormonal changes. Because of the crossover of symptoms between fibromyalgia and chronic fatigue syndrome, some interest exists in the relation of these disorders to exposure to environmental contaminants (environmental allergy is one proposed cause of chronic fatigue syndrome). So far, no evidence supports a chemical cause of fibromyalgia.

Lupus

Lupus refers to a group of autoimmune diseases of connective tissues that affect several body organs. Systemic lupus erythematosus (SLE) is the form of the disease that people commonly call "lupus." SLE affects the skin, joints, blood, and kidneys. Depending upon the severity of SLE, other organs may also be involved, and serious and life-threatening problems may occur. Some of the more common symptoms include fatigue, joint pain, rashes, fever, and kidney problems. The disease is chronic; individuals with lupus have alternating periods of increased symptoms or "flares" and remissions of the disease.

About 16,000 new cases of lupus are diagnosed in the United States each year; the estimated prevalence is 23.8 cases per 100,000 people (Jacobsen et al 1997). Women develop SLE more frequently than men, and African-American, Hispanic, Native American, and Asian women develop the disease more frequently than white women. Like fibromyalgia, no public health reporting system for lupus exists in the state of Ohio or the town of Wellington, so prevalence rates in the Wellington area cannot be evaluated.

The causes of lupus are unknown. There appears to be a combination of factors, including genetic, hormonal and environmental, that influences the development of the disease. Factors such as bacterial or viral infections, ultraviolet light, hormones, stress, antibiotics, and other drugs may trigger the disease or flares. Occupational exposure to high levels of particulate silica dust has been associated with the development of lupus (Cooper et al 2002).

Evaluation of Potential for Environmental Exposure

An evaluation of the likelihood that residents living in the Wellington area have come into contact with environmental contaminants associated with the former Sterling Foundry facility, the former LESCO facility, and the currently operating Forest City Technologies plants is complicated by the closure of the first two facilities in 2002. There is a lack of extensive, specific environmental sampling data associated with the historical operations of all three facilities. Toxic Chemical Release Inventory (TRI) data available for Lorain County for the decade of the 1990s (US EPA, TRI-Explorer 2004) does not indicate that any of these three facilities was a particularly significant source of environmental pollution compared with other industrial sources in the county. However, these data did indicate the release of generally low levels of some chemical contaminants to the environment in the immediate vicinity of these facilities during this time period.

Sterling Foundry

Anecdotal information from residents, file information of recorded citizen complaints, and Ohio EPA staff investigations of the former Sterling Foundry suggest that it is likely that residents downwind (northeast and east) of the facility were exposed to airborne emissions (dust, soot, other particulates, and volatile organic compounds) emitted from various plant operations when air pollution control devices were either not in place or not working properly. Unfortunately, no complete chemical analyses of these emissions, either in terms of their chemical composition or their concentrations, were found during a review of Ohio EPA files. As a result, it is difficult to document which chemicals and what levels of exposure to these chemicals residents might have had when Sterling Foundry was in operation.

Because the prevailing winds are from the west and the reservoir of the Village of Wellington is at least 50 feet above and to the west of the Sterling plant, it is unlikely that air emissions from the foundry impacted water quality in the reservoir in the past. Because the village water supply is a public water supply, it is regulated and regularly tested for contamination with oversight from US EPA and Ohio EPA. Review of the village water supply's compliance record by Ohio EPA staff indicated a good compliance history with no significant contaminant issues documented (Ohio EPA, memo 2/23/04).

While levels of petroleum hydrocarbons and PCBs in the sediments appear to be elevated in several of the settling ponds on-site, these chemicals are tied up in the bottom sediments and are not very mobile. It is unlikely that they could easily migrate off-site where people might be exposed to them. The ponds are fenced and padlocked, making incidental on-site exposure unlikely.

The Erie Street Landfill is currently not fenced, and evidence shows that trespassers are accessing the property. Wastes land-filled at the site and exposed at the surface appear to be primarily solid waste (slag, foundry sand, plastic, rubber, and wood) that would not pose a health threat through incidental contact with these wastes. Low levels of metals and polycyclic aromatic hydrocarbons were detected in some land-filled wastes, but these levels were similar to those detected in typical urban soils and are unlikely to result in adverse health effects through short-term dermal contact. On-site surface water and groundwater contained elevated levels of some metals. However, incidental dermal contact with site-impacted surface water is unlikely to result in adverse health effects, and groundwater resources in the vicinity of the landfill are poor, and no water supply wells were identified in proximity to and down-gradient of the landfill (Ohio Dept. of Natural Resources, well logs). The village water supply is uphill from the landfill and is not likely to be impacted by landfill surface waters or groundwater.

LESCO, Inc.

A number of hazardous chemicals, primarily herbicides, pesticides, and solvents, were formulated, packaged, and stored at this now defunct facility. Low-levels of several herbicides and pesticides were evidently released to air at the facility during the facility's operations in the 1990s (US EPA, TRI-Explorer 2004), but it is unlikely that these chemicals would be transported any significant distance. The closest residential areas are roughly a distance of 1,000 feet (and largely upwind) from the facility. A dust cloud containing these chemicals would likely suffer significant dispersion and attenuation prior to reaching these residences, reducing the concentrations of these chemicals down to levels that would not likely result in adverse health effects in these residents upon contact.

Forest City Technologies

Solvents used in industrial processes at these operational facilities contain some hazardous chemicals, primarily the hydrocarbons toluene and xylene. Neither of these chemicals are highly toxic nor are identified as human carcinogens. Both are components of many common household products, including solvents, thinners, glues, and furniture strippers. No data was available about the levels of these chemicals released to the environment in the vicinity of these plants. However, TRI data for Plant #4 during the 1990s indicated the release of up to 40,000 lbs. per year of the VOC dichloromethane (methylene chloride) to air from vapor degreasing operations at the facility. Releases to the air of DCM from the facility decreased steadily for the last several years to a low of 10,000 lbs. in 2001. DCM is a probable human cancer-causing agent and exposure at high concentrations (>200 ppm) in enclosed occupational settings has led to central nervous system depression and some evidence of infertility in workers. It is not known with certainty whether nearby residents were exposed to DCM, or if these exposures occurred, whether the levels of exposure would be high enough to result in adverse health effects. The levels of DCM discharged to the air by the Forest City Technologies facility were within the permitted limits for the plant set by the Ohio EPA.

Child Health Considerations

Children may be more vulnerable than adults for developing health problems from certain exposures to hazardous substances. Because of behavior patterns of children, this vulnerability may be especially true at sites that involve direct contact with soil. Exposures from the three industries evaluated for Wellington were primarily airborne. The cause of MS, the primary health concern for the community, is generally diagnosed during the third or fourth decade of life; however, it is believed that environmental triggers to the disease may occur during childhood. No environmental data was available for Wellington that conclusively determined any association between exposure to environmental contaminants and the development of MS.

Conclusions

Based on the environmental data available to ODH and ATSDR on the industries in the Wellington area, no significant contaminants of concern were identified in human exposure pathways at concentrations that would likely result in adverse health effects. The causes of MS, the primary health concern in this community, are unknown; the disease is believed to be caused by a combination of genetic and environmental factors.

This evaluation did not suggest any additional hypotheses for the cause of MS. ODH and ATSDR recognizes that the data available are limited in type, quantity, and time period of sampling; thus, the industries studied posed an *Indeterminate Public Health Hazard*. Sterling Foundry and LESCO, Inc. are now closed, and current environmental data from Forest City Technologies do not suggest any on-going public health hazard.

Recommendations/Public Health Action Plan

- On completion of the MS case-control study, ODH and ATSDR will reevaluate the environmental data to determine if any associations determined by the case-control study have any relation to the environmental data available from Wellington, Ohio.

- Given that Sterling Foundry and LESCO Industries are now closed and that there is nothing suggestive about the environmental data available for Forest City Technologies to warrant sampling, no additional sampling is recommended at this time.

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Table 1. Reported Air Emissions from Former Sterling Foundry facility, Wellington (*In* Tons/Year, Ohio EPA Emissions Reports, 1995 – 2001)

Year	Particulates [multiple sources]	Sulfur Dioxide [core ovens]	Nitrous Oxide [core ovens]	Organic Compounds [storage areas]	Volatile Organic Compounds[1] [storage areas]	PM10* [multiple sources]
1995	39.69	0.23	0.31	19.43		
1996	51.87	0.31	0.42	25.74		
1997	67.88	0.40	0.57	37.90		
1998	52.15	0.42	0.58	35.33		
1999	41.31	0.33	0.80	29.56	28.99	15.01
2000	43.55	0.33	0.92	36.25	36.25	14.95
2001	41.98	0.32	0.85	36.23	36.20	14.62

* = Particulate Matter 10 microns or larger in size
[1] = Most all organic compounds = volatiles = reported to be methanol (US EPA Toxic Release Inventory data)

Table 2. Air Releases per Source (Tons/Year), Sterling Foundry facility, Wellington, Ohio (1997–2001)

Source	Permitted Level (Tons/Yr)	1997	1998	1999	2000	2001
F008 Bakeline core-making	Part = 4.8 OC = 7.3	0.34 NR	0.67 NR	0.61 NR	0.79 NR	0.67 NR
F009 Bakeline core-making	Part = 4.3 OC = 7.3	2.10 NR	1.66 NR	1.27 NR	1.42 NR	1.27 NR
F010 Bakeline mold-making	Part = 2.1 OC = 7.3	0.93 NR	0.83 NR	0.52 NR	0.78 NR	0.78 NR
F011 Induction Furnace	Part = 14.2 Lead = 0.5	3.27 NR	3.32 NR	2.59 NR	2.65 NR	2.50 NR
K002 Painting Operations	Part = 6.1	NR	NR	NR	NR	NR
P001 4-1 Shot Blaster	Part = 59	9.26	9.41	7.32	7.60	7.10
P005 Casting Shake-out	Part = 23	3.64	3.94	2.76	2.04	1.93
P006 Greensand Mullers	Part = 49	17.81	2.62	4.93	4.93	5.10
P008 Grinding Wheel	Part = 65	0.10	0.11	0.06	0.07	0.07
P009 Turn Blast	Part = 45	0.10	0.11	0.08	0.07	0.07
P010 Core Ovens	Part = 21.5	3.86	3.99	3.10	3.18	3.01
T123 Storage Areas	Permit Not Required?	35.19	32.66	29.52	36.21	36.20

Part = Particulate Matter
OC = Organic Compounds
NR = No emissions reported

Table 3. Chemicals detected in groundwater samples from the Sterling Foundry Erie Street Landfill (URS Greiner Woodward Clyde 1999).

Chemical	Range of Detections	Typical Background	Drinking Water Standard
Total Dissolved Solids (parts per million/ppm)	950 – 2,900	2,200 – 2,250[1,2]	500*
Sulfates (ppm)	ND – 615	1,140 – 1,390[1,2]	250*
Bis(2-ethyhexyl) Phthalate (Parts per billion/ppb)	ND – 40	NA	6
Metals (Unfiltered)	(ppb)	(ppb)	(ppb)
Arsenic	ND – 62	5 – 10[3]	50/10
Barium	99 – 450	15 – 1,980	2,000
Cadmium	ND – 3.3	ND – 6	5
Chromium (Total)	ND – 110	ND – 30	100
Iron	7,600 – 146,000	2,700 – 6,400[1,2]	300*
Lead	3.8 – 95	ND –40[3]	15
Nickel	ND – 200	ND – 144	100
Zinc	30 – 450	ND – 426	5,000
Metals (Filtered)	(ppb)	(ppb)	(ppb)
Barium	4.7 – 450	NA	2,000
Iron	ND – 770	NA	300*
Nickel	ND – 32	NA	100
Zinc	ND – 150	NA	5,000

* = Secondary Maximum Contaminant Level (SMCL) – water quality only; standard not health-based
1 = Source: ODNR, Groundwater Resources of Huron County (1986)
2 = Source: ODNR, Groundwater Resources of Ashland County (1979)
3 = Source: Ohio EPA Ohio Groundwater Quality Report (2000)
NA = Data not available
ND = Chemical not detected in sample

Table 4. Reported Air Emissions from Forest City Technologies facility, Wellington (*In* Tons/Year, Ohio EPA Emissions Reports 1996-2003)

Year	Particulates	Organic Compounds	Volatile Organic Compounds [1] (lbs/Year)	PM 10*
1996	0.0	14.80	30,000	0.0
1997	0.0	10.80	22,000	0.0
1998	0.0	7.10	14,200	0.0
1999	0.0	6.42	13,000	0.0
2000	0.0	5.48	11,000	0.0
2001	0.0	4.93	10,000	0.0
2002	0.0	6.84	NA	0.0
2003	0.0	5.75	NA	0.0

* = Particulate Matter greater than 10 microns in size
[1] = US EPA Toxic Release Inventory data [all organic compounds = volatiles methylene chloride from the open-top degreaser system]
Note: Permitted maximum releases per year for Organic Compounds = 32.6 tons or 65,000 lbs)

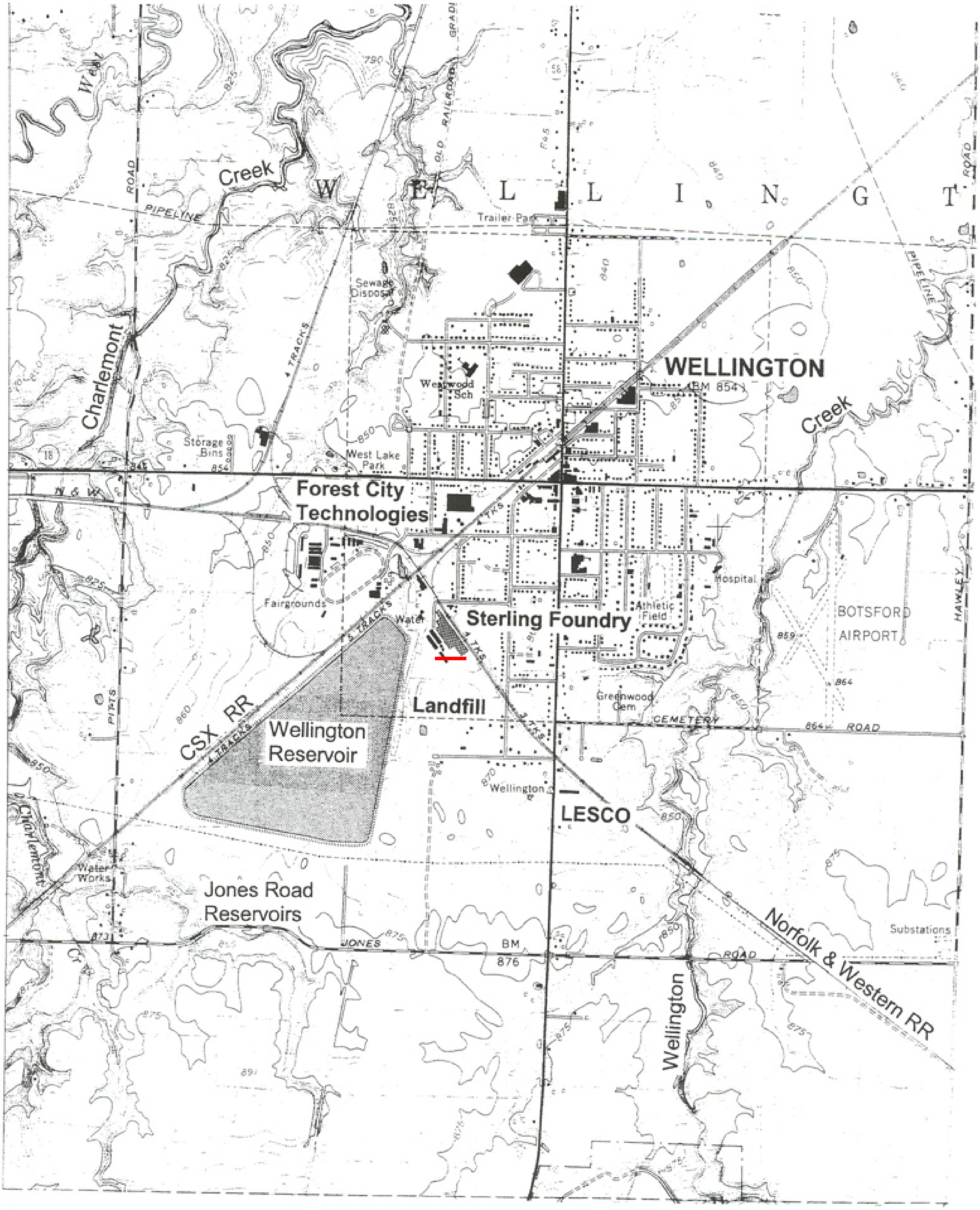

FIGURE 1. Study Area in Wellington, Lorain County, Ohio

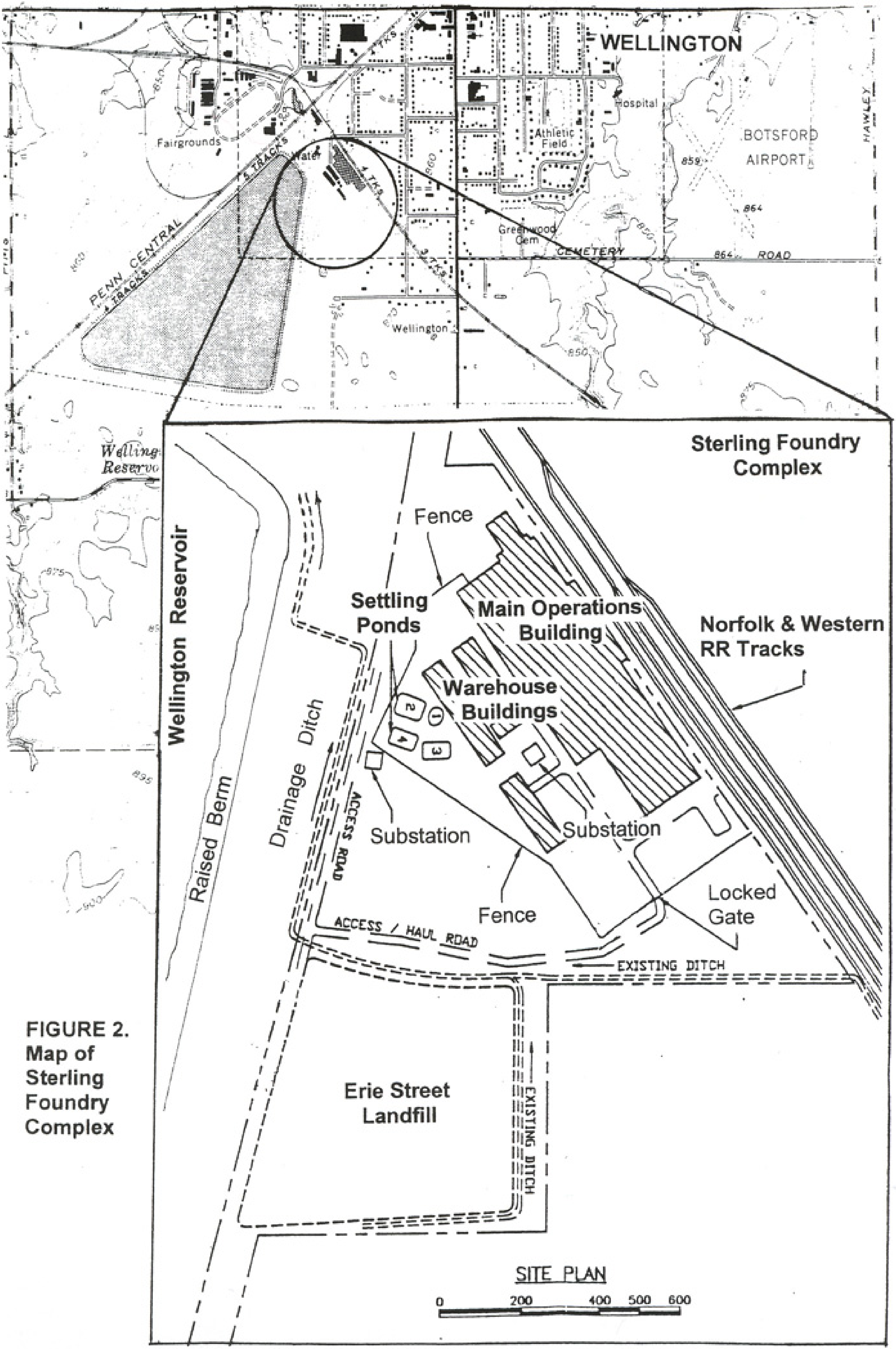

FIGURE 2. Map of Sterling Foundry Complex

Certification

This Village of Wellington Health Consultation was prepared by the Ohio Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

Technical Project Officer, CAT, SPAB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

Team Leader, Cooperative Agreement Team, SPAB, DHAC, ATSDR